Fixing (?) the Shortcomings of Map-based Approaches
Provisioned Bandwidth Information

• Applications may want to use it
  • Ono and P4P experiments show higher improvement in high-capacity areas
• ISPs have it and may want applications to use it
  • “Try local power-users before going to Korea!”
• BTW, it's in the charter...
Problem (Part 1)

- IP of residential customers primarily assigned on a topological basis
  - In the same area addresses often taken from the same pool regardless of the subscription class
    
    i.e.

- Prefix matching **inefficient** for identifying access line characteristics
  - Cannot tell between 50/10 and 2/.384 lines
### Example (Priority Maps)

<table>
<thead>
<tr>
<th>Topology only</th>
<th>Topology and bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.128.0.0/10 → 20 /* Local AS */</td>
<td>83.123.21.45/32 → 30 /* 50/10 */</td>
</tr>
<tr>
<td>83.128.0.0/12 → 30 /* Local PoP */</td>
<td>83.123.21.46/32 → 20 /* 20/2 */</td>
</tr>
<tr>
<td>85.128.0.0/9 → 4</td>
<td>83.123.21.47/32 → 1 /* Dialup */</td>
</tr>
<tr>
<td>91.0.0.0/10 → 10 /* Peering agr */</td>
<td>83.123.21.48/31 → 30 /* 2 in a row! */</td>
</tr>
<tr>
<td>99.98.0.0/16 → 5</td>
<td>83.123.21.50/32 → 10 /* 10/1 */</td>
</tr>
<tr>
<td>202.0.0.0/8 → 0 /* Australia!!! */</td>
<td>83.123.21.50/32 → 30 /* 50/10 */</td>
</tr>
<tr>
<td>204.2.0.0/16 → 7</td>
<td>83.123.21.51/32 → 20 /* 20/2 */</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Problem (Part 2)

- IP addresses of residential lines often assigned dynamically

  i.e.

- Address-by-address maps **stale** as soon as the first home gateway reboots
Question: Is it desirable to be able to provide guidance based on provisioned bandwidth? (Or on anything other than topology?)

Suggested answer: Yes, if reasonably feasible

- Huge, short-lived maps may turn out generating more traffic than the application itself

- Applications may not want to give privacy in exchange. BitTorrent won't send lists of IP addresses to ISPs, no matter how accurately they can do the ranking
Approach #1

- **Adapting** IP provisioning policies to reflect provisioned bandwidth
  - Multi-level network partitioning

```
83.128.0.0/12

83.128.0.0/18
  83.128.0.1 to 83.128.63.254 assigned to 50/10 lines

83.128.64.0/18
  83.128.64.1 to 83.128.255.254 assigned to 30/5 lines

83.128.128.0/17

83.129.0.0/16
  83.129.0.1 to 83.130.255.254 assigned to 10/1 lines

83.130.0.0/16

Entire pool (e.g. assigned to a PoP)
```
Approach #1: Pros and Cons

Pros

• Still a map
  • Simple, simplest

Cons

• May require radical changes in ISPs' provisioning policies
• Additional partitioning unlikely to reflect different parameters (bandwidth, latency...)
• May result in big files
Approach #2

• Fine-grain guidance in an additional step
  • First: a high-level map
    – “Prefer Korea, avoid Australia...”
  • Then: [take a deep breath] an accurate query/response service for areas where more detailed information is available

• Steps almost completely disjointed
  • Maps may point to second-step servers
    – “Prefer Korea, avoid Australia, detailed information about Japan available at xyzp://oracle.isp.jp...”
Approach #2: Pros and Cons

Pros

- No impact on ISP infrastructure/policies
- Incremental solution
  - Not a one-size-fits-all
  - Can stop at step 1

Cons

- Added complexity
  - Discovery of maps and oracles
  - One protocol or two protocols?
- Privacy
  - Not all users will be happy with step 2
Approach #3

- Click to add your favorite solution
We don't need answers now, but...

At some point we'll have basically two options:

- Ignore everything that does not fit on a map
  - Provisioned bandwidth is not available bandwidth
  - IP assignment policies are just policies
  - Just topology is still better-than-random

- Design alternatives/complements to prefix-matching
  - Efficiency (no, /30 is not prefix-matching!)